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Worldwide Report

NUCLEAR DEVELOPMENT AND PROLIFERATION

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USE OF SILICON IN NUCLEAR REACTORS DISCUSSED

Prague TECHNICKY TYDENNIK in Czech No 24, 1984 p 6

[Article by Prof RNDr Helmar Frank, DrSc: "Silicon in Nuclear Reactors"]

> [Text] A fundamental property of semiconductors, which forms the basis of their use in technology, is the fact that electrical conductivity and other parameters depend on purity, i.e., the extent to which low concentrations of foreign atoms are present and the possibility of affecting the physical parameters by external factors such as electric and magnetic fields, heat, light, pressure, and all types of radiaiton.

Foreign atoms, which are accidentally present as a result of incomplete purification of the primary material, are called impurities. Technologists attempt to eliminate these impurities as efficiently as possible. Only when the concentrations of impurities drop below a certain value, which depends on the width of the fobidden band, does the intrinsic conductivity of the simiconductor manifest itself. For example, in the case of silicon, which is currently the most important semiconductor technologically, only one foreign atom can be present per 10^{10} silicon atoms for it to be considered pure. Such pure silicon is, however, practically unusable for semiconductor applications. The requisite concentration of electrons is obtained by the intentional addition of a certain low concentration of atoms which produce electron (type N) or hole (type P) conductivity.

The deliberate contamination of previously optimally purified silicon is a case of what is referred to as doping with an impurity. Phosphorus is the impurity most commonly used to obtain type N conductivity (five valence electrons, or one more than is needed to bond with silicon, which has four valence electrons) while boron is used to give type P conductivity (with three valence electrons, i.e., one less than silicon). The excess electron of the phosphorus atom is only weakly bound and its thermal energy at room temperature is adequate to ionize the phosphorus, which serves as a donor, completely, producing type N electron conductitity. Boron similarly acts as an acceptor, accepting an electron from silicon and thus producing type P hole conductivity. When an electrical current is applied, the free electrons or holes created must, in addition, move freely, and therefore the silicon must be monocrystalline.

Why Do We Welcome a New Method?

The extensive use of semiconductors makes possible electrical conductivity which can reproducibly be affected by unusually low concentrations of impurity atoms. It makes no difference whether these impurities are added to the crystal lattice by doping while the monocrystals are being grown, by ion implantation, used to produce the required geometries and concentrations needed in the making of semiconductor components and integrated circuits, or by nuclear irradiation, especially by thermal neutrons.

Silicon monocrystals are obtained by Czochralsky's method by extracting the seed crystal from a melt contained in a crucible or by zone melting in the transient zone, while the required amount of impurity is mixed into the melt. A disadvantage of this method is the difficulty in obtaining a uniform distribution of impurity atoms throughout the monocrystal. There is also inhomogeneity in the nonuniform spatial distribution of specific resistance, and the transistors produced from this type of silicon are lacking in certain properties. The method of homogeneous alloying of silicon monocrystals by thermal neutrons, through the transmutation of the isotopy ^{30}Si to phosphorus, on the other hand, produces absolutely uniform distribution of the donors throughout the entire monocrystal.

Neutrons Which Do Not Kill

Neutron alloying of silicon has been known since 1958, but only recently has it been used in our country, with great success in regard to uniformity, stability and yield of the manufactured components. Silicon, the second most common element in the earth's crust, is composed of three isotopes, in the ratio of 92.27 percent ^{28}Si, 4.68 percent ^{29}Si, and 3.05 percent ^{30}Si. Irradiation with thermal neutrons in a nuclear reactor transforms ^{30}Si into radioactive ^{31}Si, which undergoes beta decay, with a half-life of 2.62 hours, into the stable isotope ^{31}P. In only a few days, thanks to the short half-life, the irradiated monocrystals can be processed in the usual manner.

The concentration of the rare atoms of phosphorus, which acts as a donor, depends on the thermal neutron flux and on the irradiation time. If we use silicon with a definite specific resistance N (type P cannot be produced in this way), we must make a preliminary determination of the impurity atoms already present in a given monocrystal by measuring their concentration, and calculate the required additional concentration of donors.

If we know the thermal neutron flux in the irridiation channel of the nuclear reactor, we can set the necessary irradition time. The initial silicon monocrystal should have the lowest possible initial concentration of impurity atoms, but it is difficult and expensive to produce extremely pure silicon. For this reason, in practice we are satisfied with so-called high-resistance silicon, which is suitable if it has at least a one-order lower concentration of impurities that the silicon obtained by neutron alloying. If the inhomogeneity of the starting material is ± 10 percent, it is decreased to less than $\pm$ 1 percent.

Practical Use

The method of homogeneous alloying by the neutron transmutation of silicon was developed for the use of our semiconductor industry at the Department of Solid State Engineering of the College of Nuclear and Physical Engineering of the Czech Institute of Technology in collaboration with the Nuclear Research Institute in Reza, Tesla in Roznov, and the Ceskomoravska-Kolben-Danek Semiconductor National Enterprise. From 1980 to 1983, 50 to 80 kg of silicon monocrystals were irradiated each year, crystals produced by Tesla Roznov using the transient zone method. These monocrystals had an initial specific resistance of more than 5Ωm, and were free of dislocations amd structural defects, and had a diameter of 50 mm and a length of up to 100 mm, appropriate for the size of the cartridges used in the irradiation channel. Irradiation was carried out in the VVR-S light-water reactor at the Reza Nuclear Research Institute. After irradiation, the crystals were heat-treated and the specific resistance was stabilized by removal of lattice defects after neutron bombardment. Depending on the output of the nuclear reactor (from 2 MW to 6 MW) irradiation lasted from 1 to several dozen hours, until a final specific resistance of 0.2 to 0.8Ωm was achieved.

Neutron-alloyed silicon monocrystals are used by Tesla Roznov and CKD Semiconductors for the production of special semiconductor components--homogeneous epitaxial layers for integrated circuits. The quality of the high-voltage diodes and thyristors made using homogeneous monocrystals is signifficantly improved. Scientific knowledge has already been confirmed in practice. In addition, the introduction of neutrom alloying saves us a large amount of hard currency every year.

9832
CSO: 5100/3020

RADIOISOTOPE RESEARCH AND USE IN CSSR DISCUSSED

Prague TRIBUNA in Czech 27 Jun 84 p 18

[Interview with Eng Bedrich Fridrich, director of the Institute for the Study, Production, and Use of Radioisotopes in Prague, by Rostislav Valasek: "The Atom in the Service of Mankind"; date and place not given]

> [Text] In roughly the past decade, Czechoslovakia has experienced an unprecedented increase in the production and use of radioisotopes. There has been a roughly fourfold rise in production and a fivefold rise in use. We spoke with Eng Bedrich Fridrich, director of the Institute for the Study, Production, and Use of Radioisotopes [ISPUR] in Prague, about the current situation, the problems, and the prospects for the development of the nonpower sector of the Czechoslovak nuclear program, and where isotope production and nuclear engineering equipment should be used.

[Question] How many laboratories currently work with radioactive isotopes?

[Answer] In 1978, there were 75 laboratories, under the administration of 24 federal and national ministries, receiving radioactive isotopes. At present over 700 laboratories in the CSSR are receiving and finding applications for radioactive materials.

[Question] This is certainly a substantial increase. The Czechoslovak Atomic Energy Commission [CSAEC] has had a marked effect on the use of isotope production and the apparatus of nuclear technology. What part of the tasks of the Czechoslovak nuclear program involves nonpower tasks?

[Answer] Before answering this question, I would like to stress that the CSAEC finances state and departmental tasks of research and development. Eight of the 13 tasks of the state plan financed and coordinated by institutes under the CSAEC involve nonpower problems, but the financial support allotted to these tasks represents approximately one-fourth of the total spent on all tasks included in the Czechoslovak nuclear program.

[Question] Could you, Comrade Director, give us some details on your

statement and explain why things are this way?

[Answer] The complexity of the development of individual parts of the nuclear energy establishment is evident. It is characteristic of the research tasks of the nonpower sector of the Czechoslovak nuclear program that they may be specified for a precisely defined problem area, with a relatively low volume of noncapital investment funds, and thus with a number of specific material capital goods outputs. For these tasks, the financial and percentage share of future producers is relatively high, and we must not ignore the additional fact that this is characterized by a shorter solution time.

[Question] How would you characterize the tasks being worked on in the framework of this program?

[Answer] They must provide for an expanded range of manufacture of radioactive products, apparatus of nuclear technology, medical irradiators, semiconductor detectors, etc.

[Question] Where in Czechoslovakia is the research on and the manufacture of different radioactive materials being done?

[Answer] There are three such institute under the CSAEC. Our institute, the Institute for the Study, Production, and Use of Radioisotopes, specializes in compounds such as those used in scientific research. In addition, we do research on radioactive irradiators for industrial laboratories and on the standards used for a variety of measurements.

The Institute for Nuclear Research [INR] in Reza near Prague does work on radiation pharmacology for medical purposes, while the Institute for Radioecology and the Use of Nuclear Technology [IRUNT] in Kosice works on radioanalysis equipment.

[Question] Radioisotopes find wide application in medicine. What new developments are to be expected?

[Answer] Actually, there are several. Currently new compounds are being developed for use in research and industry, which are manufactured biosynthetically, as well as radioactive drugs to be used by medical laboratories for diagnosing liver, brain, lung, kidney, and tumor function. New apparatus includes radioimmunological equipment for studying the functioning of the immune system, [and equipment] for monitoring therapy of cardiac illness, for irradiation to determine whether domestic animals are pregnant, or to establish the levels of toxins in animal feeds and in foodstuffs.

[Question] In 1974 the CEMA member countries ratified a "Multilateral Agreement on Specialization and Cooperation in Isotope Production." How does your institute participate in this collaboration?

[Answer] The agreement facilitates the complete utilization of our research and production facilities. The institute exports about 20 percent of its production according to this agreement. In less than a decade the export of the specialized products of our institute has nearly doubled.

[Question] We have not yet spoken of equipment technology.

[Answer] The CSAEC traditionally collaborates in its work with the Tesla company, whose Research Institute for Nuclear Technology Apparatus in Premysleni is not only the major laboratory for research and development in this area, but also a small-scale manufacturer. At present, the workers of the institute are working on both dosimetric and radiometric apparatus--for example, devices for nuclear medicine, for environmental monitoring, dosimetric devices for radiation hygiene and radiotherapy, devices to measure radioactive contamination, etc. The INR also works on the development and production of germanium semiconductor radiation devices. The list of laboratories involved in the development of nuclear technology also includes the above-mentioned and rapidly expanding institute in Kosice. This is the coordinating laboratory of the state plan, which is working out an approach for monitoring environmental pollution and developing nuclear engineering equipment for this purpose. Such an apparatus is manufactured by a factory in Spiska Nova Ves, part of the Kosice institute, which specializes in the production of nuclear engineering equipment.

[Question] For several years work has been conducted within the framework of the nuclear program, on radiation equipment for oncological purposes, used to treat malignant tumors. What results have been achieved in this area?

[Answer] We have to do here with the development of circular particle accelerators which produce particles used for medical purposes. This problem is the concern of the Foundation for the Development of the Uranium Industry in Ostrova nad Ohri. Cesium and cobalt irradiators and a medical betatron--a type of circular particle accelerator--have been developed. Research and development during the 5-year period also includes the further automation of the 22 MeV medical betatron. Such work has confirmed that a betatron with an energy of 20-25 MeV van be used in 85 to 90 percent of cases to treat malignant tumors. Another success of the Czechoslovak nuclear program has been the development of the Chirasim X-ray simulator by the Chirana company, which, along with the automated betatrons which we will produce, will form part of the high-quality equipment of the Czechoslovak oncological laboratories.

[Question] What are the results of testing under practical conditions?

[Answer] At present the first prototype of a simulator to give good results is being constructed in the Radiotherapy Institute at Bulovka, Prague, and another is being constructed in a clinical laboratory in Moscow. The technical parameters of the X-ray simulator are the result of collaboration between Czechoslovak and Soviet specialists and are at a very high level.

[Question] We might title the next chapter: "New Methods, New Possibilities." I have in mind radioanalytic methods. To what extent are they already in use in the national economy?

[Answer] Radioanalytic methods are already indispensable for the analysis of materials in certain areas. Thus, for example, the Institute for Mineral Raw Materials in Kutna Hora is working on developing equipment for geological prospecting to be used directly in the field, etc. The State Materials Research Institute in Prague is investigating the use of radionucleotide methods for determining the degree of wear of parts of machine assemblies. Another very interesting approach is the use of radioactive tracers to study the movement of materials in technological processes, to check leakage from gas and petroleum lines, in hydrology, etc. The ISPUR, under the CSAEC, is working on this problem, which it considers to be one of the basic activities in the sector of nonpower use of atomic energy.

Equally interesting is the use of radionucleotides and irradiation in radiation technologies. Several laboratories in the CSSR are working on this problem, the largest of these being the INR, the ISPUR and the State Textile Research Institute--the Center for Traditional Technology in Veveraka Bityska. As time goes on, however, the outlook for using radiation technology and radiation methods in the national economy is less promising than it appeared two decades ago.

[Question] Why?

[Answer] At that time some authors considered radiation technology to be a universal cure-all. Today we can say that radiation technologies can, under certain conditions, find application in many areas. Among the more significant achievements of our radiation chemists and engineers are radiation vulcanization of silicon rubber conductors using the electron accelerator in the Vrchlabi cable factory. Unfortunately, another area in which radiation technology might have been used in the cable industry--i.e., the gridding of polyethylene insulation--runs into difficulties with regard to the acquisition of suitable raw materials. Another result of research within the framework of the Czechoslovak nuclear program is the introduction of new technology into production in the area of radiation sterilization.

[Question] Radiation technology can also be used to destroy pests in valuable wooden antiques. Is this method used in actual practice?

[Answer] Yes, it is. Cobalt radiation is being used to this purpose. We can speak of the successful application of radiation technology in connection with the work of the Central Boehemian Museum in Roztoke near Prague, but this method should be extended to other museums throughout our republic.

[Question] With regard to certain problems in research on the production of isotope products and nuclear engineering equipment, how would an expert characterize these?

[Answer] The production of isotope products and nuclear engineering equipment is becoming increasingly more feasible and has certain characteristic features. Among these are, for example, the specific conditions for work with radioactive materials, the use of expensive equipment for production and research, small volumes, and small-scale production. The unique character of these products means that we cannot achieve labor productivity equal to that of an assembly-line situation. For the same reasons, production sectors and enterprises are not interested in this type of production, in part because the economic gain from the use of radioactive methods rests largely with the users.

[Question] Can you tell us about the conditions for further development of the production of isotope products and nuclear engineering equipment?

[Answer] The CSAEC is making systematic efforts to create the necessary conditions. This also holds for the introduction of new organizational forms, the so-called research and production units, since 1980 the ISPUR, and since 1981 the IRUNT in Kosice. This new organizational form is intended above all to create conditions within institutes for the more rapid implementation of the results of research.

9832
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NUCLEBRAS HEAD VIEWS ARMS RACE WITH ARGENTINA, COOPERATION

Rio de Janeiro JORNAL DO BRASIL in Portuguese 25 Jun 84 p 16

[Article by Wilson Thimoteo: NUCLEBRAS Seeks Nuclear Cooperation with Argentina"]

[Text] "Each country is attempting to solve its financial problems. I do not believe in a nuclear race between Brazil and Argentina; I believe rather in the search for cooperation, which has shown great progress recently," said Dario Gomes, president of NUCLEBRAS, in commenting on Argentina's nuclear program.

He does admit, however, that Argentina has reached a higher stage of development than Brazil, although it has been limited by budgetary restrictions in the past 2 years.

"They have two nuclear power plants in operation, one under construction (Atucha II), and are designing a fourth," said Dario Gomes, stressing that the Argentines are currently reviewing their program's budget, just as the Brazilians are doing.

Two Plants

The Argentines already have two fully operational nuclear power plants--Atucha I and Rio Tercero--each with about 350 megawatts.

The National Atomic Energy Commission of Argentina was established in 1950 and celebrated its anniversary on 31 May. After completing its first phase, under the new government of President Raul Alfonsin it has been reviewing the nuclear program which was approved in 1979.

The program, which consists of four more plants with 600 megawatts based on natural uranium and heavy water, envisions bring Atucha II on stream in 1987. NUCLEP, the NUCLEBRAS subsidiary responsible for equipment manufacture, built the containment vessel for the Argentine nuclear power plant.

The Cuyo I plant will be the second link in the chain, going into operation in 1991. The program specifies that the other two plants are to go into operation in 1995 and 1997.

According to recent statements by the president of the National Atomic Energy Commission, Alberto Constantini, published in CLARIN of Buenos Aires, the budgetary restrictions imposed on the Argentine nuclear program will represent an adjustment of 20 percent above the commission's initial forecasts for this year [sentence as published]. He also noted the delay experienced by Atucha II in beginning operations, which has now reached 2 years; the delay of somewhat more than 20 months in the construction of a fuel-processing plant; and the limitations facing uranium prospecting.

"To abide by the budget changes ordered by the Ministry of Economy it was necessary to cut the funds for Atucha II and the heavy-water plant by 20 percent. Briefly, we will save 10 percent this year, but next year we will have to pay 10 percent more. There is no doubt that the work already begun will encounter increased costs when delayed," the president of the National Atomic Energy Commission said to CLARIN, repeating a warning frequently made by the authorities of the Brazilian nuclear program.

Deadlines Postponed

The original goal of the Argentine nuclear program envisioned that 16.6 percent of all electric power would be nuclear by this year, with 44.1 percent thermal and 39.3 percent hydroelectric power.

According to the NUCLEBRAS chairman, upon completion of the eight nuclear plants called for in the Nuclear Plan in addition to Angra I, the Brazilian plan for the year 2000 foresees an output of electric energy as follows: 84 percent hydroelectric, 7 percent coal and 9 percent nuclear.

The Brazilian nuclear program, which budgets a direct cost of $18.6 billion excluding indirect costs (mainly interest payments), originally called for construction of the nine plants by 1990.

Angra II and III, which were supposed to begin operation in 1986, have been delayed until 1989 and 1990, respectively. Angra I has not operated at 100 percent capacity since it began operations last year.

As a result of all the delays, the most optimistic current forecast is that the plants will not be ready until the year 2000, a delay of 10 years.

The nuclear program so far has cost around $2.3 billion in direct costs and has already committed around $1.7 billion more, according to Dario Gomes

He also foresees that the uranium-enrichment plant, which was included in the program, will begin operations around 1988, at which time it will begin to supply enriched uranium (3.5 percent).

2641
CSO: 5100/2119

BRIEFS

GOLDEMBERG SCORES PROGRAM--Jose Goldemberg, physicist and president of the electric power enterprises of the State of Sao Paulo, said yesterday in a joint interview shortly before the SBPC symposium on "Nuclear War," that so far the Brazilian nuclear program has had no concrete effect on energy production and that the $4 billion investment (4 percent of the Brazilian foreign debt) could have been much better used by CESP [Power Plants of Sao Paulo]. He also said that, although considered to be "unfounded allegations," unofficial efforts are being exerted toward producing nuclear weapons for Brazil. He feels, however, that Brazil ought to oppose the arms race and not provide incentives for other Latin American countries to produce nuclear weapons, as has occurred in India and Pakistan. Professor Goldemberg believes that Brazil should not distance itself from protests against the arms race between the United States and the Soviet Union, pointing out that various European countries, of which Holland is the latest, have prohibited the installation of nuclear missiles on their territory. In his opinion, the problem concerns everyone because the explosion of 2,000 nuclear bombs--there are 10,000 bombs in the world--would produce an enormous black cloud in the stratosphere which would block solar radiation. This phenomenon, which has been called the "nuclear winter," would, according to the scientist, reduce temperatures on the earth by as much as 40 degrees Celsius for a year, destroying most of civilization indirectly, not to mention the direct damage of explosion, heat, and radioactivity. According to Goldemberg the "nuclear winter" was inconceivable 2 years ago. [Text] [Sao Paulo O ESTADO DE SAO PAULO in Portuguese 6 Jul 84 p 9] 2641

DOMESTIC EQUIPMENT FOR ANGRA--NUCLEBRAS expects that domestically manufactured electronic equipment used in building the Angra II and Angra III nuclear powerplants now under construction will represent 22 percent of all the electronic equipment installed in those plants, and is planning that the domestic-content level will reach 100 percent in the next two plants to be built, Iguape I and Iguape II. These plans were announced by Dario Gomes, president of the enterprise to the Executive Secretary of SEI [Special Secretariat for Information Science], Commander Jose Ezil Veiga da Rocha, at a meeting held this week at NUCLEBRAS headquarters. Dario Gomes explained to the head of SEI that, when equipment was ordered for Angra II and III during the 1970's, it was expected that 5 percent of the electronic systems would be of domestic production. But one of the goals of the nuclear program is to produce domestically all the technology connected with nuclear

energy. For this reason NUCLEBRAS, along with all Brazilian industry, is constantly attempting to increase domestic content in this area. "As regards information science," Dario Gomes said, "after a series of studies it was felt possible that even Angra II and Angra III would be able to achieve a level of 14 percent domestic content in electric and electronic control systems." [Text] [Rio de Janeiro JORNAL DO BRASIL in Portuguese 30 Jun 84 p 16] 2641

FRG PLANT FINANCING--Salvador--NUCLEBRAS is in an advanced stage of negotiation with the German Urangesellschaft [Uranium Company], which is interested in financing the construction of a mining and industrial complex in Lagoa Real, in central-south Bahia. This complex is to produce uranium concentrate in exchange for guarantees that it will sell part of its output to Germany at international market prices. This information comes from the managing director of NUCLEBRAS, Jose Pinto de Araujo Rabello. According to the director, the uranium deposits in Lagoa Real offer excellent conditions for commercial exploitation, not only because of the volume (reserves are estimated so far at 93,000 tons of uranium concentrate) but above all because of the good quality of the ore. [Text] [Rio de Janeiro JORNAL DO BRASIL in Portuguese 29 Jun 84 p 15] 2641

NEVES ON FRG ACCORD--Sao Paulo--In a press conference held during the dedication ceremony of the new headquarters of the Sao Paulo branch of the Brazilian Democratic Movement Party [PMDB], Democratic Alliance presidential candidate Tancredo Neves yesterday said that a distinction should be made in foreign relations between the political field and the economic field. In his opinion, consensus exists in the country regarding the guidlines Itamaraty has been following up until now in the political field. Neves views the nuclear issue as highly significant. In his opinion, that country which has not been following up on nuclear technology is today falling behind and is losing its position in the international community. Neves said: Regarding the Brazilian-FRG nuclear agreement, we really have to examine it to adjust it to the economic possibilities of our country. We cannot indulge in the luxury of maintaining agreements which we cannot afford. [Excerpts] [PY211739 Rio de Janeiro O GLOBO in Portuguese 19 Aug 84 p 2]

ANGRA I NUCLEAR PLANT RESUMES OPERATIONS--The Angra I nuclear plant, which has been closed for 2 and 1/2 months for repairs to its refrigeration system water pump, is back in operation at the so-called critical phase, that is, the reactor is operating and uranium is being fissioned. It will begin to generate electricity on 24 August at the rate of 3 percent per hour, and it will be connected to the Furnas Electricity Company system. Furnas experts expect that by 27 August the Angra I plant will reach its full generating power of 626 megawatts. Once the plant operates at 100 percent power for 100 consecutive hours, the guarantee granted by Westinghouse will have been fulfilled and the plant can go into commercial operation. [Excerpt] [PY240002 Sao Paulo O ESTADO DE SAO PAULO in Portuguese 23 Aug 84 p 30]

CSO: 5100/2136

NUMEROUS EXPRESSIONS OF CONCERN OVER PLUTONIUM SHIPMENT

Risk Described as 'Incalculable'

PA081935 Panama City LA PRENSA in Spanish 8 Aug 84 p 11 A

[Article by Julio Yao]

[Text] The transit through the Panama Canal of a vessel bearing a 250-kg shipment of plutonium, a highly radioactive material, implies a danger of incalculable consequences for our country's national security. A slight accident could result in the eradication of the Republic of Panama. Thus, the Panamanian people must oppose the transit of this ship.

The danger lies not only in the nature of the material, but in the way it is being transported and in its extreme vulnerability to accidents and other possibilities. Its danger was made evident by the fact that other nations will not allow it to transit their territorial waters, and became even more evident when it was reported that the Navies and Air Forces of three countries (the United States, the United Kingdom, and France) will closely watch over the passage of this vessel. In addition, its danger is quite genuine, for 15 U.S. congressmen have protested the transfer of such a dangerous shipment, 189 kg of which, according to them, would be enough to build 30 nuclear warheads.

Moreover, this is the first time that this material will have been tranferred by sea, and Cogema of France, the reprocessing firm, had absolutely no experience in doing this. For this reason, "a huge security network" is being prepared, with the participation of several powers.

By saying that "the Commission has no authority to deny its passage through the canal," Fernando Manfredo, deputy administrator of the Panama Canal Commission, is implicitly admitting that the United States has this power, with which Panama, on the basis of the treaties, has absolutely no right to interfere. But it is the United States itself that has authorized the transit of the plutonium shipment through the canal.

In addition, when Manfredo said that ships with dangerous cargoes cannot transit the canal unless they take special security measures, he made a mistake. In the Neutrality Treaty, Panama promised to allow free transit at all times to military and other vessels from all nations, "independent of their internal operation, propulsion, origin, destination, and weaponry, without establishing inspection, search or vigilance as conditions for permitting this transit." Furthermore, according to Article III (1-E) of the so-called Neutrality Treaty, "these ships will have the right to refuse to disclose their internal operation, origin, weaponry, shipments, or destinies."

..s is the contractual basis that binds Panama not to interfere or effectively exercise its jurisdiction over the transit of ships; and that Neutrality Treaty will be in effect from here to eternity! As for international law, this clause implies a huge jurisdictional concession in favor of "free transit" and a self-inflicted mutilation of our national sovereignty.

These agreements, in which a state is compelled to refrain from exercising its sovereignty, are not valid according to international law, because they are presumed to be the result of a negotiation in which one of the parties involved, through the exercise of indisputable superiority, imposed certain commitments on the other that damage its independence, its free determination, and its territorial integrity.

In this case, the commitments agreed upon with the United States prevent the Republic of Panama from complying with one of the first rights and duties of any state, which is its legitimate defense and the preservation of the security of the territory and the nation. The articles of the Neutrality Treaty that could be used to support the right of a ship loaded with plutonium to transit the canal without permitting Panama to prevent it lose all legal effect, because when clauses such as these are confronted with fundamental legal principles they wither away, losing their moral content and their binding nature by the mere citation of the abiding principles.

Based on this reasoning and taking into consideration the fact that sovereignty lies, as the last resort, in the people themselves, I propose that we disregard such antinational agreements and patriotically oppose that ship's transit of the canal, with its cargo of death. Let them find another route, or let the Americans ship it in one of their nuclear submarines via the North Pole!

S..e time ago, the Ohio, a U.S. nuclear submarine of the Trident type, went through the canal. This submarine was carrying a destructive power that was 1,040 times greater than that which destroyed Hiroshima and Nagasaki! However, it went through the canal unnoticed. The Panamanians must put up strong resistance to the free transit of all sorts of vessels through our territory, our territorial seas, and our internal waters without any regard for the fate of our country or that of its inhabitants.

Our nation's sovereignty and security must take precedence over any treaty.

PST Opposition

PA091714 Panama City CRITICA in Spanish 9 Aug 84 pp 48, 18

[Article by Antonio Grael Flores]

[Text] The Socialist Workers Party [PST] is opposed to the passage of a vessel carrying a plutonium cargo equivalent to 30 nuclear warheads, the same amount that was dropped on Hiroshima 39 years ago, through the Panama Canal, on the grounds that the entire country may run the risk of disappearing, while neighboring countries could suffer great losses. PST President Herasto Reyes made that remark to CRITICA.

"The national government, which is entrusted with the security and integrity of all Panamanians, must prevent that vessel from going through the canal, because such a dangerous vessel endangers the lives of all Panamanians," Reyes added.

Reyes stressed that there could be a leak of radioactive plutonium while the vessel is crossing the interoceanic canal.

He demanded that Fernando Manfredo, our representative on the Canal Commission, intercede as deputy administrator and as a Panamanian to prevent the passage of vessels carrying nuclear cargoes.

PST Objection Repeated

PA131646 Panama City LA PRENSA in Spanish 13 Aug 84 p 11 A

[From "The People Speak" column by Ramon Fernandez Domenech]

[Text] The Socialist Workers Party [PST] has raised its voice "against the passage of a ship loaded with nuclear cargo" that is slated to transit the canal shortly. It also demands the dismantling of "all the military junk in the School of the Americas." According to a PST communique, the "decision regarding the passage of a ship loaded with nuclear cargo was made by the imperialist commands. The government's position, adopted through its national representatives in the Canal Commission, is irresponsible," as the PST feels that "that body does not have the authority to deny passage through the interoceanic waterway to this deadly ship." The PST also wants the facilities of the School of the Americas "to become the patrimony of the University of Panama so programs and projects for the expansion of the university can be developed."

Assurance From Manfredo

PA142330 Panama City MATUTINO in Spanish 14 Aug 84 pp 1 A, 8 A

[Article by Eduardo Martinez Fernandez]

[Text] Fernando Manfredo, deputy administrator of the Panama Canal Commission, has stated that the commission will adopt special security measures when the vessel that is en route to Japan carrying more than 200 tons of plutonium, a material used to make nuclear warheads, passes through the canal. Manfredo said that one of the measures to be taken by the body which administers the passageway will be to request a condition certificate from the vessel carrying the cargo. The vessel will anchor at a special place far from other vessels in canal waters. Moreover, the vessel will be given priority in order to make its passage as speedy as possible and to have this done during daylight hours for the greatest visibility. The vessel will be navigated by the commission's most experienced pilots and traffic will be cleared; that is, there will be no other vessels in the area while the plutonium is being transported.

In an interview on Panamanian radio, Manfredo said that navigation permits cannot be denied to any vessel wanting to cross the interoceanic passageway. Manfredo said that the exact date of the vessel's arrival in Panamanian waters is still unknown, but its arrival must be announced at least 24 hours in advance. Manfredo said that Panama Canal Commission rules state that vessels carrying cargo described as "dangerous" must meet several requirements at the port of departure and that an inspection certificate issued by a reputable agency specializing in the handling of nuclear materials must accompany the vessels.

To conclude, the deputy administrator said that should other considerations not included in the regulations arise, experts in nuclear matters must make the appropriate recommendations. Then, in the event of serious risks, Panama will ask for restrictions on the vessel's passage.

Conadesopaz Communique

PA200128 Panama City LA PRENSA in Spanish 19 Aug 84 p 8 A

[Text] The National Committee for Defending Sovereignty and Peace, Conadesopaz, has issued a communique denouncing the danger involved in the transit of a vessel carrying plutonium through the Panama Canal. This is the text of the communique:

Conadesopaz, hereby addresses itself to the Panamanian public in order to denounce the danger entailed in the transit of a vessel carrying plutonium through the Panama Canal. As we are all aware, plutonium is a basic radioactive material used to make nuclear bombs. It has been reported that the amount of plutonium to be taken through the canal is more than enough to make 32 atomic warheads, each of which might suffice to wipe entire cities from the map.

As is understandable, the transportation of these types of nuclear materials has been closely and severely considered in international maritime law with the express purpose of avoiding unnecessary exposure to radiation dangers by countries not involved in the nuclear materials exchange. It is completely unnecessary for Panama to submit to the risk of receiving a nuclear load that is to move through the country's center, precisely where most of the population is concentrated in its territory. This load could very well be transported via this continent's southern tip, thereby avoiding populated areas.

It is totally unacceptable that matters of so fundamental an importance for the country's safety and the lives of its people be irresponsibly and arbitrarily decided by U.S. authorities, without any consideration for the will of Panamanians. We hereby denounce this stance by U.S. authorities as one that violates the Torrijos-Carter Treaties, the basic purpose of which is to grant Panamanians the right to make their own decisions on things related to their security and national welfare. We appeal to all citizens to make a pronouncement rejecting the planned transit of the plutonium-loaded vessel through our country.

PST Statement

PA240046 Panama City YA in Spanish 23 Aug 84 p 15

[Socialist Workers Party, PST, statement in the "Public Opinion Trends" column: "No Ships With Plutonium or Schools for Assassins"]

[Text] A ship carrying enough plutonium for 30 nuclear warheads like the ones that exploded 39 years ago in Hiroshima will transit the Panama Canal, endangering the entire country and areas beyond it.

Imperialist commands granted it passage. The Panamanian Government, which is supposed to safeguard the safety and security of all Panamanians, through its representative in the Panama Canal Commission, irresponsibly said that the commission is not authorized to deny passage through the waterway to this deadly vessel.

Our country's inability to decide whether a ship that threatens public safety should transit the canal or not is another consequence of the pro-imperialist Torrijos-Carter treaties, which all Panamanians who struggle for sovereignty opposed in 1977.

In the defense of our safety and to protect our lives, all Panamanian people should join together to prevent the passage of that ship laden with radioactive plutonium through the canal. However, we must also recognize that for years our territory has housed a danger to the people of the American continent which has had consequences as deadly as the ones that can come upon Panama if plutonium leaks from the vessel when it crosses the canal. We are speaking of the School of the Americas, the cave where the armies of Central and South America, which have caused hundreds of thousands of deaths, tortures, and disappearances in Latin America, come for training.

The 1977 treaties mortgaged our sovereignty "permanently." Americans decide what ships will transit the canal; Americans decide who will run the School of the Americas to continue serving the interests of the U.S. Pentagon after 1 October when it is scheduled to be turned over to Panama.

The only way to stop other nuclear ships from transiting the canal, to dismantle schools for assassins and U.S. military installations made legal through [word indistinct] treaties is to fight the Torrijos-Carter treaties, the legal instruments that justify the violation of Panama's sovereignty.

Therefore, the Socialists urge the Panamanian people, particularly the students and young people, to fight against the passing of that deadly ship through the canal, to demand that the military junkyard and the buildings of the School of the Americas be dismantled and turned over the University of Panama to develop extension programs.

[Signed] Socialist Workers Party

CSO: 5100/2137

MINISTER SPEAKS IN DEBATE ON NUCLEAR POWER PLANTS

New Delhi PATRIOT in English 7 Aug 84 p 6

[Text]

State Minister for Atomic Energy Shivraj Patil reiterated the Indian Government's stand in the Rajya Sabha on Monday that Indian nuclear installations could be put to an international inspection only if other nations too are subjected to a similar inspection.

Any discrimination against India in this regard was not acceptable as India could not be treated in "isolation", he made it clear.

Mr Patil was replying to points raised in the House during the debate on a call attention motion with regard to atomic power plants in the country that stood in the name of Congress-S member Suresh Kalmadi and five others.

The Indian scientists, he said, had done a good job in the field of atomic energy and it was because of their efforts India has achieved "self-reliance" in mining of atomic minerals, enrichment of requisite fuel and fabrication of its own atomic reactors.

"We are also developing an atomic reactor that will use plutonium as fuel", he added.

Stressing that Indian atomic development was mainly for peaceful purposes, he said the country had attained the technology to use nuclear science in agriculture, health and other peaceful areas.

India had enough uranium reserves to meet the requirement of installing of 10,000 MW of nuclear power by 2,000 AD, he said, adding that by setting up a number of heavy water plants it would be possible to meet the requirement of such a nuclear power programme.

Answering a charge that some foreign forces were out to scuttle the country's nuclear programme, the Minister said that it was difficult to establish a conclusive proof with respect to such matters, but the "difficulties" created by some forces gave the impression that they did not like India to develop its nuclear capabilities.

On the overall performance of the nuclear power stations, Mr Patil said that save Kota plant in Rajasthan all other units were doing well.

Earlier, Mr Kalmadi charged that Indian nuclear power development had received a set-

back after the 1974 Pokharan atomic blast.

With the Pokharan blast, he charged the Indian Government had closed "all its doors" and the result was that nuclear power development and heavy water production had gone 'haywire'.

Keeping in view Pakistan's preparation for a nuclear weapon, he said India should be bold enough to acknowledge the need for developing nuclear weapons and wanted the Indian nuclear plants to be opened to inspection by an international nuclear body.

Other Opposition members who spoke wanted the nuclear development in the country to be open to the scrutiny of Parliament and other agencies and not be allowed to remain shrouded in secrecy.

Janata member Shanti G Patel demanded an amendment to the Atomic Energy Act to make the managers of the nuclear power stations accountable. He also wanted the Prasad Committee recommendations and report on atomic plants to be made public.

BJP member Jaswant Singh said that the Government should not treat all the questions regarding the nuclear programme as anti-national and there was a need for in-depth discussion on the subject in Parliament.

Lok Dal member Hukumdeo Narain Yadav demanded setting up of a high powered committee to look into all aspects of nuclear power development in the country.

Congress-I member Sibte Razi felicitated the Government for its efforts to find alternative fuel for nuclear power station despite hurdles put by the super powers. He felt that atomic power stations were not doing as badly as the Opposition had alleged.

At the end of the Minister's reply, Mr Kalmadi walked out of the House saying that the Minister had not replied his questions fully.

His main question, he said, referred to the Talchar Heavy Water Plant developed with the help of a West German firm.

The West German firm, he said, had been given "completion certificate" and its contract was to end in next two months despite the fact that the plant did not have "even a proper trial run".

CSO: 5150/0039

ENVOY IN U.S. NOTES PAKISTAN NUCLEAR DEVELOPMENT

Calcutta THE TELEGRAPH in English 2 Aug 84 p 3

[Article by Sharon Butler]

[Text]

Washington, Aug. 1: The Indian embassy in Washington is taking "careful note" of reports that Pakistan is developing nuclear weapons capability.

"Our own estimate is that Pakistan has the capability to make nuclear weapons," said Mr Peter Sinai, charge d'affaires at the embassy. "We have received repeated assurances that Pakistan's nuclear programme is entirely peaceful. We hope that those assurances can be relied upon."

The most recent report, printed in the *Washington Post*, detailed how three Pakistanis bought kryprons from an American company and attempted to export them to Pakistan. They were stopped by US customs officials and indicated on charges of trying to smuggle nuclear weapons parts out of the US. The Pakistan government disclaimed any knowledge of the three men's activities, but American and Indian officials express doubts. Such reports "add to our anxieties," said Mr Sinai.

At a time when India is trying to improve relations with its neighbour, the issue of Pakistan's pursuit of nuclear capability remains a sensitive one. Privately, Indian officials express the "deepest concern." They reiterate that they do not want an arms race with Pakistan, but fear that if Pakistan were to embark on an open weapons programme, or if it were to explode a nuclear weapon, political pressure to follow suit would develop in India.

In 1981, when the Reagan Administration first proposed its $3.2 billion aid package for Pakistan, it argued that US military assistance would turn the Pakistanis away from the nuclear option by meeting Pakistan's security needs.

Asked what he thought of this argument in light of the recent reports, one Indian official said, "We have always been mystified by some of these arguments."

"In the old days, the argument was that the guns would fire only one way," he said, referring to US assurances in the fifties and sixties that US weapons supplied to Pakistan would not be used against India. "And then they fired the other way. And after that, they keep telling us that this is how the gun is going to fire."

Indian analysts here feel that the US Administration is genuinely concerned about nuclear proliferation and would not like to add a new member to the nuclear club. At the same time, they note that the US has treated the nuclear programmes of Israel and South Africa with a certain "indulgence," and they worry that the Pakistani programme might also be treated with the same indulgence.

But Republicans tend to overlook matters when US security concerns are at stake. In March the Democratic senators, Mr Alan Cranston and Mr John Glenn, proposed an amendment to the foreign assistance act which would have required an immediate cutoff in US assistance if the President could not certify that Pakistan was not "overtly or covertly" acquiring materials for the manufacture of a "nuclear explosive device." The amendment was approved, but five days later deleted. It was replaced by an amendment proposed by three Republicans, Senator Larry Pressler, Senator Charles Mathias and Senator Charles Percy. The amendment required only that the President certify that Pakistan did not possess a nuclear explosive device.

Similarly, when the Pakistan aid programme began, Pakistan was granted a six-year exemption from the Symington and Glenn amendments which required a cutoff in US aid if a country were found to be acquiring enrichment or reprocessing technology. With the exemption Pakistan would lose its aid only if it exploded a nuclear device.

It is the Republican Administration's forbearance towards its anti-Soviet partners which requires constant monitoring and worries Indian analysts here. Asked if the US were doing enough to prevent the flow of nuclear weapons technology to Pakistan, one Indian official said, "Enough efforts would be efforts which are successful.

CSO: 5150/0038

FRANCE ENLARGING NUCLEAR COOPERATION WITH INDIA

New Delhi PATRIOT in English 16 Jul 84 p 7

[Text] Paris, July 15 (PTI)--France, which has been supplying enriched uranium for the Tarapur Nuclear Power Plant, is enlarging its cooperation with India in the field of nuclear energy.

A spokesman of the French Atomic Energy Commission said that experts from both countries would meet to discuss further cooperation in particle accelerators and light water reactors of the type that the Soviet Union has offered to India.

Other fields of cooperation to be discussed are radio-isotopes and radiological protection.

India which was the first country with which France had signed agreement in nuclear field in the 1960s had also offered enriched uranium fuel for the fast breeder test reactor in Kalpakkam.

India has, however, decided to use its own fuel.

France is one of the few most highly advanced countries in the nuclear energy field, apart from being a nuclear power with arsenal ranking third after the two superpowers. In 1990, France expects to produce nuclear power to the extent of 73 per cent of its total electricity generation (as against 48 per cent in 1983 and 55 per cent in the current year, hydro and thermal power accounting for 19 per cent and eight per cent respectively.

France has already 39 nuclear plants installed and 24 are under construction. The magnitude of the programme is based on its own uranium resources and the cheaper cost of the nuclear power.

The French National Assembly adopted in 1981 a plan for long term energy independence, as France had been highly dependent on foreign imported oil. The share of oil in the total energy balances had fallen to below to 48.3 per cent in 1981. This was the result of lower increase in the growth rate of energy consumption and the development of the nuclear pogramme.

France does not have much oil or gas reserves though coal deposits are extensive but these are not considered safe for working. France only produces about 22 million tonnes of coal a year for thermal power generation. Half of the coal is produced in the Lorren region in northern France. The coal being of low grade, France specialises in utilising it after washing.

CSO: 5150/0035

CORRESPONDENT INTERVIEWS BABHA CENTER DIRECTOR

New Delhi PATRIOT in English 16 Jul 84 p 5

[Text] Bombay, July 15 (PTI)--India has joined ranks with the few advanced countries which have successfully completed the fuel cycle.

"As far as research and development are concerned we have completed the fuel cycle", beginning from the mining of natural uranium to the final reprocessing of the spent fuel, Dr P K Iyengar, director, of the Bhabha Atomic Research Centre (BARC), told a visiting PTI correspondent.

Completion of fuel cycle is a very sophisticated and lengthy process involving various stages like the preparation of fuel elements and assemblies for use in a reactor, "burning" the fuel in the reactor, recovering radioactive byproducts from spent fuel, and reprocessing remaining fissionable material into new fuel elements.

Highlighting different research activities at the centre, he said the mixed oxide fuel (MOX), comprising three per cent of plutonium oxide and 97 per cent of uranium oxide, had been test-irradiated in the 40 MW reactor at BARC. The fuel gave an output of 14,000 MW days/tonne. Since plutonium is toxic, the experiment was conducted in a closed atmosphere and glove boxes.

Development of the MOX fuel was taken up as an alternative method to fuel the nuclear power station at Tarapur (TAPS), 100 Km from here, when continued supply of enriched uranium from the USA appeared uncertain.

Asked when this fuel will be used in TAPS, Dr Iyengar said, "we do not want to waste this fuel in a thermal reactor like TAPS, instead we will use the rare plutonium in the fuel in a fast breeder reactor."

He said the plan is to use safeguarded plutonium in a safeguarded reactor only. "However, one day we would like to use the MOX in TAPS," he added.

We do not want to use safeguarded plutonium at the Kalpakkam reactor, but use plutonium from Cirus (which is an unsafeguarded reactor)". The reactor at Kota in Rajasthan can be worked with safeguarded plutonium. "However, we are now reprocessing and storing the plutonium", he said.

The technology developed is so useful that plutonium can be put to use in all thermal reactors. But no decision has been taken in this regard, the nuclear expert said.

About the fuel for fast breeder test reactor (FBTR), now in final stages of completion at Kalpakkam, Dr Iyengar said, "after conducting experiments with plutonium oxide and plutonium carbide, we ultimately selected plutonium carbide".

Though plutonium oxide was suggested earlier, it was found that the rate of breeding was low and critical mass was higher. In the case of plutonium carbide (with good thermal conductivity), it was observed that breeding property is high (1.4 atoms), he pointed out.

The scientist said fuel elements (the mixed carbide fuel containing 70 per cent plutonium carbide and 30 per cent uranium carbide) had been fabricated and were being shifted to Kalpakkam to be used as fuel in the FBTR--expected to be commissioned in December this year.

Dr Iyengar said experiments were performed to convert thorium to U-233. A small quantity of thorium, available in plenty in beaches of Kerala, was put in the outer core of Cirus and reprocessed to extract U-233. A small reactor PURNIMA-2, has been built at BARC for testing this uranium and studying its physical characteristic. It is the only reactor of its kind in operation in the world.

This U-233 will be used in Kamini, the swimming pool reactor to be set up at Kalpakkam, for conducting radiographic tests. Kamini is an experimental facility for developing FBTR technology.

BARC scientists are engaged in designing a 500 MW prototype fast breeder reactor (PFBR) for power generation.

About the choice of fissle material in this reactor, he said the competition was between thorium and U-238. As at present, U-238 is better. Thorium can also be used, but the breeding rate will be slightly less, he said.

On the various possibilities of enrichment of uranium, the BARC director suggested that lab scale experiments be upgraded to the industrial scale. However, this can be pursued only if the process proves economical. "As an R and D man, I should be inquisitive and prepared.

The choice is between the combinations of light water and enriched uranium on the one hand and natural uranium and heavy water on the other. "We should follow whichever is economical. Since enrichment costs are high, we should keep watching the situation. However, R and D willnot let down the country.

Above all, everything depends on the industry, generally, the procedure takes five years, Dr Iyengar observed.

Meanwhile, the 100 MW Dhruva reactor, designed and built indigenously to produce large quantities of isotopes, will be commissioned in September, he said.

Dhruva will be used to conduct engineering experiments and study basic sciences, besides materials research.

CSO: 5150/0035

SITES IDENTIFIED FOR NEW NUCLEAR POWER PLANTS

Calcutta THE TELEGRAPH in English 18 Jul 84 p 5

[Text]

Bombay, July 17 (PTI): Five sites, mainly in the southern and northern regions of the country, have been identified for setting up 22 new nuclear power plants in the near future.

To be established with an investment of Rs 13,900 crores (at 1983 prices), these reactors will be mainly in clusters of four each, Dr M.R. Srinivasan, chairman of the recently-constituted nuclear power board, said.

A detailed report has been submitted to the government by the nuclear site selection committee, which is also headed by Dr Srinivasan.

He, however, refused to divulge the exact locations. The economies of scales of installing power reactors will be better if they are situated away from coal-fired (thermal) power stations, which are mainly in the eastern regions, he said.

Of the 22 reactors, 10 will be of 500 MW each and all the rest of 235 MW each, so that by the turn of the century the installed capacity of nuclear power stations would total 10,000 MW of electricity. This would constitute 10 per cent of the total generation, as against 2.5 per cent at present.

Explaining the advantages of clusters, Dr Srinivasan said once an infrastructure was built up, the time taken for setting up subsequent reactors would be less. This would also depend on grid development, power balance and systems requirements. The scientist said this would be economic and offer ample scope to the industry to produce on mass scale various components for the reactors.

At a recent meeting, about 100 business representatives had assured him that the industry would deliver the goods on time and ensure quality control.

Dr Srinivasan said the trend the world over now was to set up clusters of four reactors. This had been demonstrated by Japan, France, the US and the Soviet Union.

RAPS recommissioning: Atomic energy officials are still uncertain about the possible date of recommissioning Unit I of the Rajasthan Atomic Power Station (RAPS), shut down for more than two years due to light water leakage.

"We are not in a position to indicate the precise time but, hopefully, it will be soon," Dr Srinivasan said. He said there were no plans to scrap the plant. Fixing it is certainly more attractive than scrapping."

Engineers have already identified two cracks, in the end shield toward the calandria of the reactor, responsible for the leakage. Plugging the leak is a difficult task as the end shield cannot be approached due to radiation. It has to be done by remote control devices.

CSO: 5150/0037

PROGRESS IN NUCLEAR POWER GENERATION REVIEWED

BK241702 Delhi General Overseas Service in English 1340 GMT 24 Aug 84

[Commentary on "Harnessing Nuclear Energy for Development" by Biman Basu, science writer]

[Text] The latest annual report of the International Atomic Energy Agency released in Vienna last week forecasts a steady rise in global nuclear power generation in the coming years despite a slowdown in the construction of new plants in some countries. The report says that by the end of next year nuclear energy will provide 15 percent of world electricity as against less than 12 percent at the moment.

The actual percentages vary widely from country to country. France, for instance, generates 50 percent of its electricity using nuclear energy. Compared to the world figure, India's nuclear power generation program is modest. At the moment nuclear energy contributes less than 3 percent of the country's total electricity generation. The five nuclear plants now in operation generate a total of about 1,100 megawatts, but the picture is changing fast. Keeping with the world trend, the country has recently taken up an ambitious expansion plan which will raise India's nuclear generation capacity more than tenfold by the end of this century. India will then produce more than 10 percent of its electricity using nuclear energy.

India's experience in the peaceful uses of nuclear energy dates back to the midfifties when the country's first experimental reactor was commissioned at Trombay. The first nuclear power plant was set up at Tarapur in 1963. Since then four more power reactors have come up, and five more units are in different stages of construction. Under the new expansion plan 22 new nuclear power reactors are to be set up by the year 2000 AD. The total nuclear generation capacity will then go up to 10,000 megawatts.

A significant feature of India's nuclear power generation program over the years has been the development of indigenous capability in all aspects of nuclear power generation. The first reactor at Tarapur was purchased from the United States on a turnkey basis. The latest unit at Kalpakkam has an input content of less than 10 percent. In fact, Indian nuclear scientists and technologists can now design, build, and run a nuclear plant without any outside help. The reactors currently in operation and under construction all use uranium as fuel. However, in view of India's limited reserves of uranium, the second phase mf reactors to be used in future will be of the breeder type which produces more fuel than it consumes.

The technology of fast breeder reactors is far more complex than that of the conventional reactors now in use. At present only a few countries, notably France, have the expertise in designing and operating breeder reactors. India is developing the technology of its own. The country's first prototype fast breeder test reactor at Kalpakkam has been entirely designed and fabricated by Indian scientists and engineers. The reactor is ready for commissioning by the year-end.

A significant development in this context has been the work of Indian scientists on an alternative fuel for the breeder reactor. Normally such reactors use enriched uranium. For the Indian breeder, reactor fuel was originally to be supplied by France, but the deal had to be scrapped because of prohibitive price quoted by the suppliers. In their efforts to find a suitable alternative, Indian scientists have now come up with fuel based on plutonium-uranium-carbide which will be used in the prototype breeder reactor at Kalpakkam.

Another important achievement in recent months has been the successful operation of a small test reactor using uranium-233 as fuel at the Bhaba Atomic Research Center. This is the only reactor in the world running on uranium-233, which is obtained from thorium found abundantly in the beach sand of Kerala. The third generation of India's nuclear plants will use thorium as fuel of which the country has vast reserves.

India's achievements in the field of nuclear power generation have not been without problems. Unfulfilled commitments for the supply of fuel, heavy water, and spare parts have greatly hampered progress, but we have gone ahead undeterred. Today India is the only developing country which has the complete infrastructure for a viable nuclear power program. It has the capability not only of mining, extracting, and fabricating fuel for nuclear reactors but also of designing, building, and operating nuclear power reactors besides facilities for heavy water production, reprocessing of used fuel, and waste management. Most important of all, Indian industry is now in a position to support a rapid expansion of the country's nuclear power program.

CSO: 5100/4744

BRIEFS

KALPAKKAM REACTOR PROGRESS--Madras, July 19 (PTI)--With just five months left for commissioning, nuclear scientists at the Reactor Research Centre (RRC) at Kalpakkam, about 80 kms from here, are speeding up work on the development of the fast breeder test reactor (FBTR). When commissioned in December, the FBTR will mark the beginning of the second phase of the country's nuclear power programme. Designed to produce 15 mw of electricity, it is a sodium-colled loop-type fast reactor of 40 mw thermal power. The reactor will use indigenously developed (at Bhabha Atomic Research Centre, Bombay) fuel-comprising 70 per cent plutonium carbide and 30 per cent uranium carbide. "The basic reason to build the FBTR is that the availability of natural uranium is limited", Dr Paranjpe said. He pointed out that though an FBTR is a little more expensive than a thermal reactor, it gives 1.5 times more energy. The reactor has been designed in such a way that if the temperature of the core increases, the chain reactor will by itself subside and the power will be reduced. Thus, the reactor is extremely stable and does not need automatic power control instrumentation. A central data processing system has been provided for data logging and monitoring responses of various reactor instrumentation. The reactor will provide experience in the design, construction and operation of liquid metal cooled fast breeder reactors (LMFBR), including power generation, Dr Paranjpe said. [Text] [New Delhi PATRIOT in English 20 Jul 84 p 5]

CSO: 5150/0036

BRIEFS

URANIUM PLANS PROGRESS--Work on developing Somalia's uranium reserves is to start later this year, Water & Mineral Resources Minister Ahmad Mahmoud Farah said during a recent visit to Jordan. Italy's Technipetrol and Brazil's Construtora Andrade Gutierez are competing for a contract to supervise construction of a uranium mine and a yellow cake plant. The mine has been under consideration since the early 1980s but has been delayed because of the high cost of extracting the ore. Original estimates put the costs of Somali yellow cake at 20-25 US dollars a kilo--well above the world market price. Scarcity of water for use in the mine was the main reason for the high cost. At first technicians thought that water would have to be brought from the Shebeli river, some 150 kilometers away. At the end of 1983, however, it was decided to drill for water close to the mine site. Drilling was completed at the end of May. Executing agency in Mogadishu is Somali Arab Mining Company, which is one-third owned by the Aman-based Arab Mining Company and two-thirds by Somali Mining Company. Finance is expected to come from Arab sources. Acceptable investment costs are put at between $200 million-250 million, according to a Technipetrol representative. [Text] [Paris AFRICAN DEFENSE in English Jul 84 p 24]

CSO: 5100/52

COGEMA, SGN SIGN REPROCESSING AGREEMENT WITH GERMAN FIRM

Paris LES ECHOS in French 27 Jun 84 p 6

[Article by D. D.]

[Text] COGEMA [General Company for Nuclear Materials] and the General Company for New Technologies (SGN), on the French side, and the Hanover company, DWK [German Society for Nuclear Fuel Reprocessing], have signed a cooperation agreement on questions relating to the reprocessing of nuclear fuels.

Francois de Wissocq, the president of COGEMA who announced this reinforcement of Franco-German cooperation yesterday during a press conference, said that the agreement fell within the framework of our neighbors' plan to install a plant of this kind either in Bavaria or Lower Saxony.

In the near future, German technologies will familiarize themselves with the latest technologies at the COGEMA plant in La Hague. The SGN will also be associated with the engineering and operating aspects of the future plant (350 tons at the beginning of 1990) planned by DWK.

For Francois de Wissocq, this agreement constitutes recognition of his group's expertise. Since the beginning of this year, the La Hague plant has reprocessed 37.4 tons per month of fuels used in the light-water power plants, an increase of about 20 percent over the 1983 performance figures.

However, the Cotentin plant is still nothing more than a vast workshop--the largest in Europe today--in which 40 to 50 billion francs will be invested from now to 1991. The plant has provided employment for 45,000 persons for 5 years.

The day following the company's general meeting, its president emphasized the progress made in consolidated sales figures: 17.6 billion francs compared to 15.2 billion francs in 1982, producing a gross profit of 3 billion francs but a slightly negative net profit because of EURODIF [European Diffusion Agency].

An Opening to the U.S.A.

On the other hand, the mother company has produced a net profit of 60 million francs. However, it will not distribute dividends to its stockholder, the AEC [Atomic Energy Commission]. But Francois de Wissocq expects to resume this distribution for the present fiscal year.

The figures for 1984 could soften, however, because of renegotiation of a Soviet contract for enriched uranium. By mutual agreement, Moscow will postpone until after 1990 the provision of about 6 million UTS [expansion unknown] earmarked for EDF [French Electric Company].

On the other hand, the COGEMA group, which already conducts 38 percent of its activities outside of France, could still develop that sector this year, particularly in the United States. Although the builders of nuclear power plants have been getting white hair for the past few months, industrialists in the fuel cycle sector continue to make out all right, even if competition is getting increasingly keen.

Francois de Wissocq has admitted that reprocessing prices will have to be adjusted in the future.

8143
CSO: 5100/2588

DRAMA EXPERIMENTAL UNIT FOR URANIUM PRODUCTION

Athens I KATHIMERINI in Greek 9 Aug 84 p 9

[Text] An experimental unit to process uranium ore found in the Drama region will be put in operation in September at Paranesti of the same area.

This semi-industrial unit now under construction at Paranest will study the actual conditions for processing the area's uranium ore deposits. The construction and operation of the unit (ECC will contribute 5 million drachmas towards the costs of laboratory research) has a budget of 8.7 million drachmas.

The unit will process in each test 10 tons of uranium ore which will yield 6 kilos of final product (in the form of a yellow powder) known internationally as "yellow cake" whose value is 4.5 million drachmas per ton.

It is noted that of the verified deposits only in three of the 16 locations--in an area of 30 kilometers--in the Paranesti-Drama region are estimated by the Institute of for Geological and Mineral Research [IGME] to yield pure uranium containing metal of more than 400 tons.

Laboratory tests in 1983 showed that it was possible to process the ore and this led IGME to install this experimental unit.

In the context of its research activities to locate uranium ore throughout the country, IGME put special emphasis on its exploration in Eastern Makedonia where, in the region of Paranesti-Drama, it has found a large area with uranium ore deposits.

Following the discovery of these deposits IGME has put together a broader and complex exploration program on the land surface and underground in order to acquire more complete knowledge of the related data which will allow the economic and technological exploration of the deposits.

7520
CSO: 5100/2586

MINISTERIAL CONFLICT OVER AKKUYU CONTRACT BIDS

Istanbul MILLIYET in Turkish 23 Aug 84 p 7

[Text] It has transpired that the tender for the projected Akkuyu nuclear power plant paved the way for a dispute between the Premier's Assistant, Kaya Erdem, and the Minister of Energy and Natural resources, Cemal Buyukbas. It is claimed that the conflict which arose from the "unseen side" of the bidding for the nuclear power plant has reached "uncontrollable" dimensions and has become the locus of an "international" controversy with the stepping in of the German and American governments.

"Westinghouse" Bid File

According to information obtained, first the "TEK" [Turkish Electric Power Enterprise] experts and then the Ministry of Energy and Natural Resources officials concurred in the view that they should limit their bargaining to only 2 of the firms which participated officially in the bidding. However, the American-Japanese corporation [Westinghous-Mitsubishi) which was excluded on the grounds that it had not submitted an offer "on time and of adequate scope" objected to its proposal not being taken into consideration since it was "far less costly and offered favorable interest rates." The Premier's Assistant, Kaya Erdem, himself showed interest in the US-Japanese corporation's offer and so he contacted the Minister of Energy and Natural Resources Buyukbas to ask him to review it. When the Minister of Energy and Natural Resources, Cemal Buyukbas, refused to open the Westinghouse bid file the matter turned into an escalating confrontation between the 2 ministers. It has been learned that in the face of this, Kaya Erdem is striving to submit the question to the Council of Ministers so that it will review the Westinghouse bid which the Minister of Energy and Natural Resources refused to take into consideration.

Competing German, Canadian, US Firms

According to the information obtained by the MILLIYET correspondant, the Westinghouse-Mitsubishi firms applied to the TEK for the construction contract of the nuclear power plant. On the pretext that the bid of the dual firms, which have an international "eligibility" status, did not include the "necessary

documents" it was turned down by the TEK and Energy and Natural Resources officials. The bidding took place between the Germen KWU and the AECL-Parsons which is a Canadian-British corporation. The Minister of Energy and Natural Resources, Cemal Buyukbas, who made the last call for bids to those 2 firms has gone on to negotiations for a final lowering of the bids' cost, on next Monday and Tuesday with the KWU, and on Wednesday and Thursday with the AECL corporation. It has been learned that, in view of the forthcoming negotiations, the Westinghouse corporation has asked the US government to step in and request that their own offer be also included.

It has been disclosed that the US-Japanese corporation submitted a bid for a completion cost of $2.5 billion which includes "escalation" for a 988 megawatt nuclear power plant, versus a $2.8 billion completion cost bid from the KWU German firm for a 1,000 megawatt plant. It has also been determined that the Canadian-British corporation made an offer of $1.9 billion for a 665 megawatt plant.

It was learned also that the US firm had promised to bring in 85% of the contract's cost in the form of foreign credits and that the German firm had guaranteed foreign credits on the same level. However, it was also learned that the US firm did not ask for any interest on the $600 million slice of credits, agreeing to recover it through the "offset" system, that is by marketing Turkey's export products in the world; and that the Japanese partner of the US firm, Mitsubishi, had also promised $600 million worth of credits guaranteed by the Japanese government and that both firms had guaranteed that the $600 million slice of credits would be secured from world money markets. Against that, the German firm KWU made an offer to find 85% of the credits under the guarantee of the German government.

Persons close to government circles pointed out that officials of the German and US governments had stepped in and that the President of the Federal Republic of Germany, Kohl, has personally written a letter to Premier Turgut asking for the German bid to be selected.

It has been learned that the Minister of Energy and Natural Resources, Cemal Buyukbas, still persists in his refusal to open the US firm's bid file but that he might use that offer as a "trump card" against the above mentioned firms in the final bargaining to lower their prices at the beginning of next week. Reliable sources declared that the Minister of Energy and Natural Resources Buyukbas would probably reach a decision by the end of next week and submit the matter to the Premier which might be debated at that stage by the Council of Ministers while Kaya Erdem might be able to get the US firm's proposal reviewed there and also obtain that the final bargaining also takes place there.

Among the claims that are made by various circles, it is being said that the "uncontrollable conflict" which has arisen between Kaya Erdem and Cemal Buyukbas because of the nuclear power plant bidding might pave the way to new dissension within the government.

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